Center Innovation Fund: ARC CIF

Integrated Focal Plane Wavefront Estimating for Space Mission Coronagraphs

Completed Technology Project (2017 - 2018)

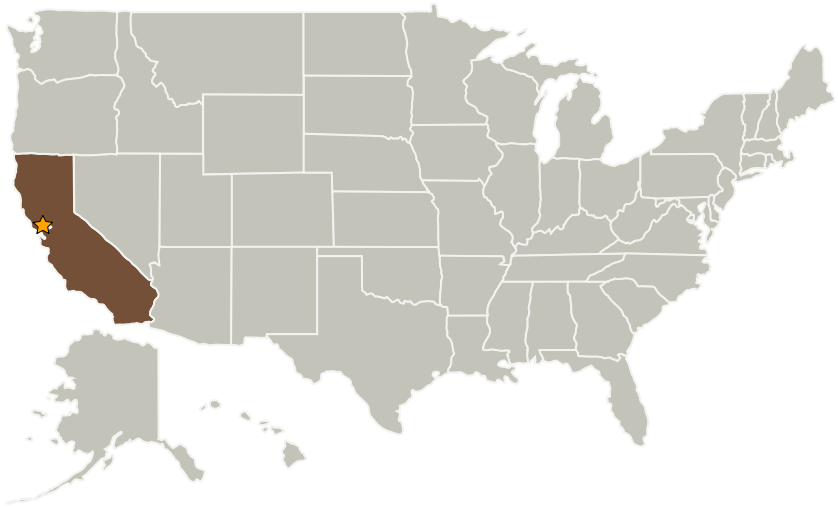
Project Introduction

Almost all proposed space coronagraph instruments for directly imaging exoplanets need wavefront estimation and control. Our project provided a new way of doing wavefront estimation. Similar to existing methods, our method uses a Deformable Mirror (DM) to provide sufficient and controlled diversity to enable reliable coronagraph phase retrieval. However, our key innovation is taht we do it without relying on the model of the DM. Our recovers both phase and amplitude of the pupil/Lyot plane by using a sequence of randomly aberrated partially-correlated focal plane images. In our case random optical aberrations are produced artificially by the DM and caused naturally by long term optical instability of the system.

Anticipated Benefits

This work directly supports the Agency exoplanet exploration priorities, and in particular missions to directly image exoplanets, such as WFIRST, LUVOIR, and HabEx, as well as potential Explorer-class missions.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California

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Primary U.S. Work Locations
California

Project Transitions

October 2017: Project Start

September 2018: Closed out

Closeout Summary: This work addresses one of the critical challenges for starl ight suppression in missions to directly image exoplanets: wavefront error estim ation. Current methods rely on moving parts or an accurate system model. Our method provides a wavefront error estimate with no moving parts, and no need for a system model. This makes it lower cost and robust to model errors. Ultima tely, it can lead to greater performance and science yield on missions to directly image exoplanets. We demonstrated static and dynamic error wavefront reconst ruction in a coronagraphic system (PIAA coronagraph) in the lab, advancing the TRL to ~4.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Center Innovation Fund: ARC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

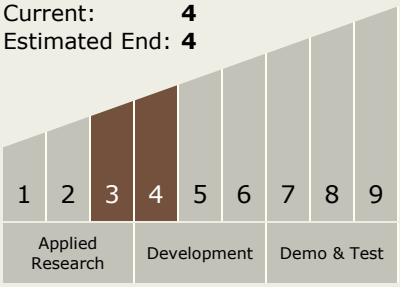
Harry Partridge

Principal Investigator:

Ruslan Belikov

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

Others Inside the Solar System, Outside the Solar System